California Rice Field Mosquitoes

Worldwide, over 140 million hectares are devoted to rice cultivation. Much of this area is found in countries of the tropics and subtropics where malaria still constitutes a serious human health problem. Because rice fields are flood-irrigated, they provide ideal breeding habitat for a number of potential mosquito vectors of malaria. One of these vectors, *Anopheles freeborni*, lays its eggs in rice fields in northern and central California. However, not all rice fields produce high numbers of mosquitoes. The goal of this research was to evaluate the use of remote sensing (RS) and geographic information system (GIS) technologies to identify the high mosquito-producing fields.

Collaborative research conducted by investigators at NASA Ames Research Center, the University of California at Davis, and at other research institutions, demonstrated that RS and GIS technologies can be used to identify high anopheline-producing rice fields with greater than 90% accuracy. These high-producing fields could be identified two months prior to peak anopheline production using three different approaches. In the first approach, Landsat Thematic Mapper (TM) data were used to distinguish between rice fields based on the rate of canopy development. It was determined that rice fields with rapid early season canopy development supported higher anopheline larval populations than fields that developed later. One method of characterizing canopy development was to use the Normalized Difference Vegetation Index (NDVI), which is a RS-derived indicator of the presence and condition of green vegetation. It was also possible to distinguish between high and low anopheline-producing fields by combining the NDVI characterization of canopy development with GIS measurements of distance (30K) between rice fields and cattle pastures (potential bloodmeal sources). Rice fields with high NDVI values located near cattle pastures were found to produce the highest anopheline populations.

Finally, it was found that high and low anopheline-producing fields could be distinguished based on the landscape composition surrounding individual rice fields. Rice field anopheline production was positively associated with landscapes that contained a mixture of cattle pastures and orchards (resting sites), and negatively associated with landscapes dominated by rice and other annual crops. These approaches can be used to direct mosquito control measures in California, or, with modification, in other rice-growing regions of the world where malaria transmission remains a human health problem.

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For further information on this research, contact Byron Wood.

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